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Dielectric relaxation in complex systems: Quality sensing and dielectric properties of honeydew melons from 10 MHz to 1.8 GHz

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Abstract

Based on new data treatment methods, it is possible to identify the fitting function for the complex permittivity ε(jω) measured for a complex system representing plant tissues of honeydew melons in the frequency range (107 to 1.8·109 Hz) at 25°C. The identified fitting function contains 9 fitting parameters and well describes the plant tissue permittivity. These parameters vary for different tissues; their correlation behavior with respect to soluble solids content (SSC), tissue density (TD) and moisture content (MC) are found by a new approach based on the statistics of the fractional moments (SFM). These correlation dependencies expressed in the form of correlation functions can be used for quality sensing of different complex systems, in particular, for ripe fruits and vegetables, where direct relationships between molecular and fitting parameters are not easy to find. These correlation functions can be used for practical purposes to construct a desired calibration curve with respect to quality factors, as for example, moisture content or degree of maturity, expressed in terms of SSC value. The discovered common "universality" in dielectric behavior of such complex materials as plant tissues opens a possibility to use dielectric spectroscopy as a nondestructive method of control in analysis of electrical behavior (measured in the form of complex permittivity or impedance) for other complex materials. © 2006 IOP Publishing Ltd and SISSA Data processing methods; Data reduction methods; Analysis and statistical methods.